

affecting the rotor based on the magnetic flux detected by the magnetic flux detector.

16. A magnetic bearing apparatus according to claim 15; wherein the motor is a brushless DC motor comprised of a plurality of magnetic poles fixed to the rotor and a plurality of coils wound around the respective magnetic poles.

ADDITIONAL FEES:

No additional fees are believed required; however, should it be determined that a fee is due, authorization is hereby given to charge any such fee to our Deposit Account No. 01-0268.

REMARKS

In the last Office Action, the specification was objected to based on minor informalities. Claims 1-7 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite. The Examiner identified numerous phrases in the claims as being vague and indefinite. Claims 1-7 were further rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,455,966 to Barada ("Barada") in view of U.S. Patent No. 4,629,262 to Hamilton ("Hamilton"). The Examiner stated that Barada discloses a magnetic bearing apparatus comprising a rotor 11, a motor portion 13 provided in the

rotor for rotating the rotor by a magnetic force, magnetically supporting coils 16a/16b for magnetically supporting the rotor in a radial direction in a predetermined position, and a magnetically support adjustment means for adjusting the magnetic force of the magnetically supporting coils so as to resist the unbalance of the magnetic force. Hamilton was cited as disclosing a position sensor for a magnetic suspension system including a feedback loop having an unbalance force obtaining means which derives a signal representative of the applied force and includes a force sensor 72 and a force command signal 74.

By the present response, the specification has been amended in suitable editorial respects to improve the wording and correct informalities, including those noted by the Examiner. Claims 1-7 have been canceled and replaced by new claims 8-16 which are believed to avoid the indefiniteness problems noted by the Examiner.

Applicants respectfully submit that claims 8-16 are patentable over the prior art of record.

Newly added independent claim 8 recites a magnetic bearing apparatus comprising a rotor, a motor having stator coils for generating a rotary magnetic field for rotating the rotor, magnetic supporting coils for producing a magnetic force for magnetically supporting the rotor in a radial

direction thereof, composite magnetic force inferring means for inferring composite vectors of the magnetic force affecting the rotor according to the rotary magnetic field, and magnetic support adjustment means for adjusting the magnetic force produced by the magnetic supporting coils to offset the composite vectors of the magnetic force in the motor.

Accordingly, the magnetic force inferring means of the inventive magnetic bearing apparatus infers composite vectors of the magnetic force affecting the rotor according to the rotary magnetic field applied to the rotor by the motor. Neither Barada nor Hamilton disclose this claimed feature of the present invention.

The magnetic suspension system of Hamilton has a position sensor and a feedback loop that derives a signal representative of an applied force and includes a force sensor 72 and a force command signal 74. In Hamilton, However, the control system originates its own output. In accordance with the present invention, composite vectors of a magnetic force affecting a rotor are determined in accordance with the magnetic field applied to the rotor by the motor.

Accordingly, neither Barada nor Hamilton discloses or suggests the claimed invention. Accordingly, applicants respectfully submit that newly added claims 8-16 patentably distinguish over the prior art of record.

In view of the foregoing amendments and discussion,
the application is now believed to be in condition for
allowance. Accordingly, favorable reconsideration and
allowance of the claims are respectfully requested.

Respectfully submitted,

ADAMS & WILKS
Attorneys for Applicants

By: 

Bruce L. Adams
Reg. No. 25,386

50 Broadway
31st Floor
New York, NY 10004
(212) 809-3700

I hereby certify that this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to: COMMISSIONER OF PATENTS & TRADEMARKS, Washington, D.C. 20231, on the date indicated below.


Paul R. Hoffman

Name

Signature

March 20, 2003

Date

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

Paragraph beginning at page 1, line 4 has been amended as follows:

The present invention relates to a magnetic bearing apparatus and to [, for example,] a magnetic bearing apparatus for reducing vibration caused by run-out in a radial direction of a rotor.

Paragraph beginning at page 1, line 8 has been amended as follows:

A magnetic bearing is constituted by the arrangement of, for example, a plurality of coils (electromagnets) around both end portions of a rotor (rotary member). In an ordinary bearing, a rotor is pivotally supported by means of ball bearings or the like. However, in the magnetic bearing, a magnetic field generated by coils is applied to the rotor and an attractive force due to this magnetic field is balanced so that the rotor is supported (or levitated) in a non-contact manner in a constant position in [a] space.

Paragraph beginning at page 1, line 23 has been amended as follows:

In such a system where the rotor is supported by the magnetic bearing and rotated, there are some cases where a gravitational center (or inertia center) of the rotor and a rotary axis of the rotor are not [identified with] identical to each other. When the rotor is rotated in such a condition, in the rotor, a run-out rotation in synchronism with a rotary cycle of the rotor caused by the misalignment between the gravitational center and the rotary axis is generated [would generate]. In order to suppress the run-out rotation, the magnetic bearing generates a brake force in synchronism with the rpm of the rotor. Due to this cyclic brake force, the run-out in synchronism with the rpm of the rotor on the stator side where the magnetic bearing coils are arranged [would generate] is generated in accordance with the law of action and reaction.

Paragraph beginning at page 2, line 16 has been amended as follows:

For instance, in the case where a turbo molecular pump carrying a magnetic bearing is used in an electronic microscope and so on, [it is] one of the more serious problems to be solved is how to control the vibration generated in the turbo molecular pump [is controlled].

Paragraph beginning at page 2, line 20 has been amended as follows:

Attempts [A number of researches] for suppressing the vibration caused by the above-described misalignment between the rotary axis of the rotor and the gravitational center thereof have been made. For instance, Japanese Patent Laid-open No. 259854/1995 discloses a magnetic bearing apparatus as such a magnetic bearing.

Paragraph beginning at page 3, line 22 has been amended as follows:

The explanation will be given with reference to formulae [Formulae]. In general, the attractive force F generated by the coils used in the magnetic bearing is given by the following formula [Formula].